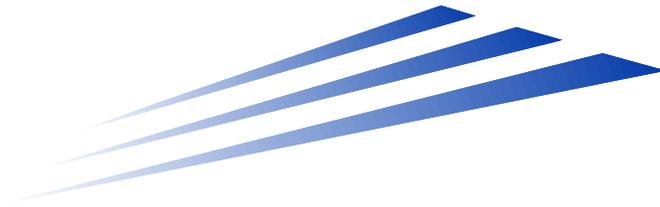


# KENTUCKY TRANSPORTATION CENTER

*College of Engineering*

**INVESTIGATION OF THE IMPACT OF LARGE TRUCKS  
ON INTERSTATE HIGHWAY SAFETY**



UNIVERSITY OF KENTUCKY



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Kentucky Transportation Center  
176 Raymond Building  
University of Kentucky  
Lexington, Kentucky 40506-0281

(859) 257-4513  
(859) 257-1815 (FAX)  
1-800-432-0719  
[www.ktc.uky.edu](http://www.ktc.uky.edu)  
[ktc@engr.uky.edu](mailto:ktc@engr.uky.edu)

Research Report  
KTC-02-5/SPR248-02-1F

**INVESTIGATION OF THE IMPACT OF LARGE TRUCKS  
ON INTERSTATE HIGHWAY SAFETY**

by

Kenneth R. Agent  
Research Engineer

and

Jerry G. Pigman  
Research Engineer

Kentucky Transportation Center  
College of Engineering  
University of Kentucky  
Lexington, Kentucky

in cooperation with

Kentucky Transportation Cabinet  
Commonwealth of Kentucky

and

Federal Highway Administration  
U.S. Department of Transportation

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February 2002



Commonwealth of Kentucky  
**Transportation Cabinet**  
Frankfort, Kentucky 40622

**Paul E. Patton**  
Governor

**James C. Codell, III**  
Secretary of Transportation

**Clifford C. Linkes, P.E.**  
Deputy Secretary

June 4, 2002

Mr. Jose M. Sepulveda  
Division Administrator  
Federal Highway Administration  
330 West Broadway  
Frankfort, Kentucky 40602

**Subject: RESEARCH IMPLEMENTATION STATEMENT (KYSR-02-248)**  
"Investigation of the Impact of Large Trucks on Interstate Highway Safety"

Dear Mr. Sepulveda:

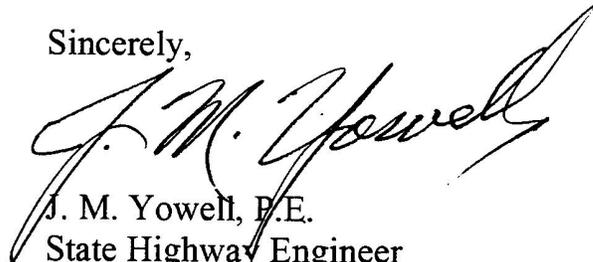
The objectives of this study were to investigate the impact of large trucks on interstate travel and offer recommendations for improving highway safety. The need for this study was based on data which indicated rapidly increasing truck volumes and disproportionate percentages of fatal crashes on interstate highways. Efforts to identify countermeasures for improved safety focused on a review of literature, analysis of crash data, and interactive discussions with representatives of the trucking industry. A wide range of safety-related countermeasures were identified and recommendations for implementation were made. Included were possible upgrades to the highway infrastructure and increased applications of intelligent transportation systems. Advanced electronic technologies and operational improvements were identified to enhance the mechanical functioning of large trucks. Driver-related issues were identified with significant potential for improvements to the overall truck safety problems through increased training and monitoring procedures.



Mr. Jose Sepulveda  
June 4, 2002  
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An effort will be made to assess and implement, where appropriate and feasible, the potential countermeasures identified as part of this research effort. Many of the potential countermeasures have previously been implemented to varying degrees. Others not yet used in Kentucky will be considered for implementation based on their potential impact on interstate highway safety.

Sincerely,



J. M. Yowell, P.E.  
State Highway Engineer

JMY/BF

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<b>16. Abstract</b>  This study concentrated on the impact of large trucks on interstate highway safety. The objectives of this study were to investigate the impact of trucks on interstate travel and offer recommendations for improving safety. The procedure involved reviewing the literature, analyzing crash data, discussing the existing situation with the trucking industry, and using the information to develop a list of countermeasures to reduce the number and severity of truck crashes on interstates. The countermeasures were grouped into the general areas of: a) the roadway environment, b) the truck, and c) the driver. The crash data were also analyzed to identify spots and sections on the interstates which had the highest number and rate of truck crashes.			
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## **EXECUTIVE SUMMARY**

This study concentrated on the impact of large trucks on interstate highway safety. The objectives of this study were to investigate the impact of large trucks on interstate travel and offer recommendations for improving safety. The procedure involved reviewing the literature, analyzing crash data, discussing the existing situation with the trucking industry, and using the information to develop a list of countermeasures to reduce the number and severity of truck crashes on interstates.

The countermeasures were grouped into the general areas of: a) the roadway environment, b) the truck, and c) the driver. The crash data were also analyzed to identify spots and sections on the interstates which had the highest number and rate of truck crashes.

## **1.0 INTRODUCTION**

Large truck involvement in traffic crashes in Kentucky (on all types of roads) and related countermeasures has been the subject of past research studies (1, 2, 3, 4). Recommendations have dealt with the vehicle, roadway, and driver. Countermeasures have included such areas as adequate truck underride protection, increased truck parking facilities, lane use restrictions, and driver training. The analysis of truck crashes has identified differences in truck crashes compared to all crashes and identified sections of various types of roadways having a high number and rate of truck crashes.

While past work has dealt with all types of roads, this study concentrated on the impact of large trucks on interstate highway safety. There is a high volume and percentage of trucks on interstate highways compared to other types of highways. With the amount of truck traffic on interstates and the understanding that crashes involving trucks are, in many instances, more severe than those involving other types of vehicles, there has been a perception of a related traffic safety problem. The objectives of this study were to investigate the impact of trucks on interstate travel and offer recommendations for improving traffic safety.

## **2.0 PROCEDURE**

### **2.1 Review of Literature**

A review of literature was conducted to determine the current state-of-the-art in the areas of the movement and safety of large trucks on interstate highways. A request was made to other states for information concerning any initiatives in these areas.

### **2.2 Analyze Crash Data**

There were three separate types of analysis used in the review of crash data. Records containing all crashes on interstates which involved a large truck were separated from the total crash data file for the years of 1998 through 2000. The first analysis involved comparing the characteristics of crashes involving trucks to all crashes. Characteristics were determined for all crashes on interstates and compared to those involving a truck. A separate comparison was made for fatal crashes. Both single unit and combination trucks were included. The unit type code given in the data base was used to determine if a truck was involved in a crash. The following unit type code descriptions were used to determine if a large truck was involved; 1) truck and trailer, 2) truck - single unit, 3) truck tractor and semi-trailer, and 4) truck - other combination. The crash report form was changed in 2000 with a code added for commercial vehicle. Characteristics of commercial vehicle crashes were also determined for 2000 and compared to all truck crashes. Data for fatal crashes were summarized for the years of 1998 through 2000.

The second analysis involved identifying the spots and sections on rural and urban interstates which had critical numbers of crashes. The following critical numbers have been determined for 1998 through 2000 when all crashes are considered (5):

	<u>Critical Numbers of All Crashes</u>	
	<u>Rural Interstate</u>	<u>Urban Interstate</u>
0.1-mile spot	6	14
0.3-mile spot	11	33
1-mile section	28	90

Critical numbers were determined for truck crashes considering the percentage of truck crashes on rural and urban interstates. Rates were calculated for the spots and sections identified as having a critical number of crashes. These rates were compared to the critical rate calculated for the specific location, and a critical rate factor (CRF) was then calculated. The CRF is determined by dividing the crash rate at a spot or section by the critical rate for that location which is calculated using the following formula.

$$C_c = C_a + K(\text{sqrt}(C_a/M)) + 1/(2M)$$

in which

- C<sub>c</sub> = critical crash rate for specific spot or section,
- C<sub>a</sub> = average statewide crash rate for type of spot or section,
- sqrt = square root,
- K = constant related to level of statistical significance, and
- M = exposure (100 million vehicle miles for sections and million vehicles for spots)

The characteristics of crashes at locations with the highest CRF were investigated. For example, the type of crash was summarized to determine if a pattern could be identified.

The third analysis involved a detailed review of fatal truck crashes. Reports were obtained for fatal crashes on interstates involving a truck for the years of 1994 through 2001 and analyzed in detail. The types of crash and contributing factors were reviewed.

### **2.3 Discussion with Trucking Industry**

An effort was made to obtain input from the trucking industry concerning problems and solutions related to truck crashes on interstates. Monthly meetings of the Kentucky Alliance for Motor Vehicle Safety (KAMVS) were attended. This group consists primarily of representatives of the trucking industry. In addition to general discussions of truck safety, the crash reports for fatal crashes involving trucks on interstates were discussed to obtain input concerning causes and countermeasures.

## 2.4 Develop List of Countermeasures

Using the input from the literature review, analysis of crash data, and discussions with the trucking industry, a list of countermeasures was developed which dealt specifically with truck crashes on interstates. The countermeasures were grouped into the general areas of: a) the roadway environment, b) the truck, and c) the driver.

## 3.0 RESULTS

The level of involvement of trucks in traffic crashes was summarized using data from annual reports which give crash statistics for Kentucky (5, 6). Following is a list of statistics which summarize the involvement of trucks in traffic crashes in Kentucky. The data are for the five-year period of 1996 through 2000.

6.6 percent of all crashes on all roads involve a truck  
12 percent of all fatal crashes on all roads involve a truck  
5.4 percent of all injury crashes on all roads involve a truck

18 percent of truck crashes occur on an interstate  
19 percent of fatal truck crashes occur on an interstate  
19 percent of injury truck crashes occur on an interstate

6.7 percent of all crashes occur on interstates  
8.9 percent of all fatal crashes occur on interstates  
6.2 percent of all injury crashes occur on interstates

18 percent of crashes on interstates involve a truck  
26 percent of fatal crashes on interstates involve a truck  
17 percent of injury crashes on interstates involve a truck

The percentages show that the percent of crashes involving trucks are substantially higher on interstates compared to all roads. This appears to be related to the higher percentage of truck traffic on interstates. Statewide volume counts indicate that trucks account for about 10 percent of vehicle miles traveled on all roads and about 25 percent of vehicle miles traveled on interstate highways. The lower percentage of crashes involving a truck compared to the percent of miles traveled by trucks indicates trucks have a lower overall crash rate compared to other types of vehicles. However, the percent involvement of trucks in fatal crashes shows that this is an area where a more detailed analysis is warranted.

### 3.1 Review of Literature

The literature review revealed a limited number of articles which dealt specifically with interstate truck crashes. There was a very limited response to a request to states for general information on truck safety on interstates.

One area of concern which was the subject of more than one report was the lack of an adequate amount of safe commercial vehicle parking on or near interstates. There is also a lack of information about parking facilities available to truck drivers and enforced parking time limits. This has resulted in trucks parking along shoulders of ramps at rest areas as well as regular interchange ramps and on shoulders along through lanes. A parking survey report has been completed in Kentucky which provided a list of the location of parking spaces on interstates and measured the demand for commercial vehicle parking (7).

The use of weigh in motion technology and automatic vehicle identification systems are among systems used to provide trucks the ability to bypass static weigh stations along interstate routes. Safety is among the benefits of these systems.

There have been recommendations about increased education to the general driving population concerning how to share the road safely with large vehicles. This has included watching for the blind spots around large trucks (referred to as the No-Zone), not cutting in front of trucks because of their limited braking capability, not tailgating because of both the relative height of the rear bumpers on trucks compared to the height of the front of most cars and the lack of impact absorption for these bumpers, and not stopping on highway shoulders.

Truck traffic restrictions and various methods of separating trucks from the traffic stream have been used. Methods include excluding trucks from portions of routes, diverting trucks from congested corridors during peak travel times, and restricting trucks to certain lanes. Trucks have also been restricted from the left (high speed) lane on roads with steep grades.

Different speed limits for trucks and cars have been used on interstates in some states. Speed studies in Kentucky have shown that, on interstates with the same speed limit for cars and trucks, the average speed for trucks is slightly less than for passenger cars (8). Another consideration is that the stopping distance from a given speed is longer for trucks than cars. However, the desire to minimize the speed differential between trucks and cars has caused many states not to have different speed limits.

Adequate training for truck drivers is an issue as well as other driver-related factors such as fatigue. Examples of driver training areas include maintaining proper logs, not exceeding the allowed number of driving hours, proper and improper stopping on shoulder, braking and handling characteristics of large trucks, and use of safety belts. A survey in Kentucky found strong support for legislation to regulate training at commercial truck driving schools and require the state to administer all tests for a truck driver to obtain a commercial drivers license (9).

There are several issues related to truck characteristics. Examples include: rear end protection, nighttime visibility of the truck, adequate and properly maintained brakes, and the use of Intelligent Transportation Systems (ITS) technology. Examples of ITS technologies are warning devices to reduce rollovers on interstate ramps and warning devices in the cab of the truck to alert the driver of closing distances to reduce rear end collisions, to identify vehicles adjacent to the truck in areas with reduced visibility, or to alert a driver who is becoming drowsy.

Safety initiatives have been used for corridors which have experienced a high number of truck crashes. Measures have included increased enforcement and advisory signs related to trucks. An example of signing directed specifically to trucks is a warning sign for truck drivers in advance of a ramp with a sharp curvature indicating when their speed is too high and may result in a rollover.

### **3.2 Crash Data**

Crash data were summarized for the years of 1998 through 2000. Also, the police report for fatal crashes were obtained from 1994 through 2001.

Characteristics of crashes on interstates involving trucks were compared to all crashes. Since the crash form used by police agencies was changed in 2000, with a separate code for commercial vehicles and a different format for the unit codes used for trucks, data from 2000 were used to compare the characteristics of all crashes on interstates with those vehicles classified as a large truck or commercial vehicle. A comparison of all interstate crashes with truck crashes and commercial vehicle crashes is given in Table 1. The data for truck and commercial vehicle crashes were very similar. Following is a discussion of the comparison of all crashes with truck crashes on interstates.

<u>VARIABLE</u>	<u>COMPARISON</u>
Severity	The percent of fatal truck crashes was slightly higher than all crashes while the percentage of injury truck crashes was almost identical.
Day of Week	The percentage of truck crashes on weekends was lower.
Number of Vehicles	The percent of single vehicle crashes was substantially lower for truck crashes (about one half of the percent for all crashes).
Road Surface	The percent of truck crashes on a wet or snow surface was lower.
Roadway Character	The percent of truck crashes on a curve was slightly less.
Light Condition	There was a slightly higher percent of truck crashes during darkness with no roadway lighting.

Time of Day	The percentages were very similar.
Month	The percentages were very similar.
Directional Analysis	There was a much higher percentage of “same direction sideswipe” crashes involving a truck (which supports lane use restrictions on roads with three or more lanes in one direction) and much lower percentages involving a collision with a fixed object or occurring at a ramp.
Type Crash/1st Event	The percentage of truck crashes involving another motor vehicle was higher while the percentage involving a fixed object was lower .
County	There was a substantially lower percentage of truck crashes in Jefferson County with a higher percentage in several rural counties.
Contributing Factors	There was a higher percentage of truck crashes in construction zones. A higher percentage of truck crashes involved failure to yield and misjudging clearance while there was a lower percentage with following too close, speed, alcohol, and several other human factors. There was generally a higher percentage of truck crashes involving a vehicular factor with the largest difference for brakes, load securement, and oversize load.

A comparison was made of all fatal crashes on interstates with fatal crashes involving trucks (Table 2). Data for fatal crashes involving trucks on all roads were included to provide another comparison. Since the amount of data for one year was limited, this comparison used fatal crash data for 1998 through 2000. Since commercial vehicle data were available only for the year 2000, this category was not included in Table 2.

VARIABLE

COMPARISON

Day of Week	There was a lower percentage of fatal truck crashes on the weekend compared to all fatal interstate crashes. The high percentage of weekend traffic on interstates is shown when compared to all truck fatal crashes.
Number of Vehicles	The percentage of single vehicle truck crashes was much lower.
Road Surface	The percent of truck crashes on a wet or snow surface was lower.
Roadway Character	There was a higher percentage of truck crashes on a grade.
Light Condition	The percentage of crashes on interstates during darkness was higher than for all truck crashes. The percentage of truck crashes on interstates during darkness was less than all interstate fatal crashes.

Time of Day	Crashes on interstates had a much higher percentage between midnight and 6 am compared to all truck crashes; also, all interstate crashes had a higher percentage during this time period than only truck crashes.
Month	The largest differences on interstates were the lower percentage of truck crashes for December through February and a higher percentage for September through November.
Directional Analysis	There was a higher percentage of interstate truck crashes involving rear end, shoulder/parked vehicle, same direction sideswipe, and pedestrian collisions with a lower percentage involving fixed object, ran off roadway, and overturned in road crashes.
Type Crash/1st Event	There was a higher percentage of truck crashes with another motor vehicle and pedestrians and a lower involved a fixed object or non-collision.
County	The highest percentage of fatal crashes on interstates was in Jefferson County followed by Warren County with the percentage of truck crashes in Warren County high compared to all interstate crashes.
Contributing Factors	There was a high percentage of interstate fatal truck crashes involving road construction, improperly parked vehicles, driver inattention, and weaving in traffic. Truck crashes had a lower percentage involving alcohol, exceeding the speed limit, and falling asleep. Interstate truck crashes had a low percentage of “not under proper control” and a high percentage of failure to yield compared to all interstate crashes.

High crash spots and sections for crashes involving trucks on the interstate system were identified. Critical numbers of crashes were used to identify spots and sections for which rates were then calculated to identify locations with a crash rate above the critical rate for that location. The following critical numbers of truck crashes were used to identify the spots and sections to investigate in more detail. The critical numbers (for three years) were calculated using total crashes on interstates, the percentage of crashes involving trucks, and the interstate mileage. This was done separately for rural and urban interstates.

	<u>Critical Numbers of Truck Crashes</u>	
	<u>Rural Interstate</u>	<u>Urban Interstate</u>
0.1-mile spot	3	5
0.3-mile spot	4	10
1-mile section	9	22

In order to identify locations with critical numbers of crashes, data for crashes on interstates involving a truck, for 1998 through 2000, were combined and sorted by milepoint. The files were manually checked to locate crashes with no milepoint, a zero milepoint, a milepoint out of range for the interstate, or where the milepoint and county did not match. The reports for these crashes were then checked and corrected. After the manual review, only 2.5 percent of the crashes had to be deleted due to the lack of milepoint data or inaccurate data.

The critical rate formula requires an average rate. The overall rates for interstates were used since a separate rate for trucks has not been determined and a comparison of the percent of truck crashes with the percent of truck traffic does not indicate a substantial difference in rates. A total of 325 0.1-mile spots, 243 0.3-mile spots, and 106 1-mile sections were identified as having a critical number of crashes. I 75 had the highest number of locations identified followed by I 65. Following is a list, by interstate, of the number of rural and urban spots and sections identified as having a critical number of crashes for which rates were calculated.

<u>Interstate</u>	<u>0.1-mile spot</u>		<u>0.3- mile spot</u>		<u>1-mile section</u>	
	<u>rural</u>	<u>urban</u>	<u>rural</u>	<u>urban</u>	<u>rural</u>	<u>urban</u>
I 24	3	3	5	1	1	0
I 64	21	17	18	7	6	6
I 65	52	33	54	17	26	9
I 71	20	4	23	4	8	1
I 75	85	60	70	26	32	11
I 264	NA	16	NA	10	NA	3
I 265	NA	2	NA	1	NA	0
I 275	4	4	5	2	2	1
I 471	NA	1	NA	0	NA	0

Traffic volumes were determined for each of these locations with a rate calculated. When critical rates were calculated, only 20 locations were identified as having a critical rate factor (CRF) of 1.0 or above. A CRF of 1.0 or above means that the actual rate is equal or higher than the critical rate. Following is a list of those locations.

<u>Route</u>	<u>County</u>	<u>Milepoint Range</u>	<u>Number Crashes</u>	<u>CRF</u>
I 64	Jefferson	5.0 - 5.1	40	2.12
I 75	Scott	138.0 - 138.1	12	1.97
I 24	Christian	85.5 - 85.6	8	1.57
I 71	Jefferson	9.0 - 9.1	19	1.51
I 264	Jefferson	13.4 - 13.5	40	1.50
I 75	Boone	175.0 -175.1	14	1.42
I 75	Boone	175.4 -175.5	15	1.37
I 24	Marshall	24.9 - 25.0	7	1.34

<u>Route</u>	<u>County</u>	<u>Milepoint Range</u>	<u>Number Crashes</u>	<u>CRF</u>
I 64	Franklin	53.8 - 53.9	8	1.31
I 275	Boone	13.5 - 13.6	7	1.27
I 65	Hardin	83.0 - 83.1	7	1.16
I 75	Kenton	183.8 - 183.9	26	1.06
I 65	Hart	71.0 - 71.1	6	1.05
I 65	Jefferson	136.7 - 136.8	23	1.04
I 71	Jefferson	0.0 - 0.1	13	1.03
I 75	Laurel	48.9 - 49.0	6	1.02
I 75	Scott	138.0 - 138.3	13	1.02
I 65	Jefferson	136.4 - 136.5	24	1.01
I 65	Hart	64.1 - 64.2	6	1.00
I 75	Boone	175.3 - 175.6	23	1.00

The crash data at these locations were reviewed to determine if there was a pattern of types of crashes or if there were a high percentage during darkness or on a wet pavement. Following is a brief description of the review of the crash data at these locations.

- I 64; MP 5.0-5.1 This is at the interchange with I 65 in Louisville. Also, the 0.3-mile spot between milepoints 5.0 and 5.3 had a CRF of 0.93. The most common crash occurred on a ramp with several crashes occurring on the ramp from westbound I 64 to southbound I 65.
- I 75; MP 138.0-138.1 This is in a rural section in Scott County. Eleven of the 12 crashes involved a same direction sideswipe collision. Also, 11 were in 2000. A review of the records shows that this was the result of reduced lane widths during road construction. There was also a high percentage occurring during darkness.
- I 24; MP 85.5-85.6 This is at the US 41A interchange in Christian County with several related to the interchange.
- I 71; MP 9.0-9.1 This is at the I 265/KY 841 interchange in Jefferson County. About 3/4ths of the crashes related to the ramps and merging.
- I 264; MP 13.4-13.5 This is at the KY 864 (Poplar Level Road) interchange in Jefferson County. The most common crash types were rear end and same direction sideswipe.
- I 75; MP 175.0-175.1 Several were related to the KY 338 interchange in Boone County. There is a truck stop at this interchange. The most common type was a same direction sideswipe related to changing lanes.

- I 75; MP 175.4-175.5 This is a section in Boone County where the most common type of crash (slightly over one half) was a rear end.
- I 24; MP 24.9-25.0 This is at the Purchase Parkway interchange in Marshall County. There was no pattern.
- I 64; MP 53.8-53.9 This spot is between two interchanges in Franklin County with no pattern of crashes.
- I 275; MP 13.5-13.6 The crashes at this spot were on the bridge from Kentucky to Indiana in Boone County with same direction sideswipe and rear end crashes representing the majority.
- I 65; MP 83.0-83.1 This spot is between interchanges in Hardin County with no pattern of crashes.
- I 75; MP 183.8-183.9 Slightly over one-half of these crashes at this spot in Kenton County were same direction sideswipe involving lane changes with about one-fourth rear end.
- I 65; MP 71.0-71.1 Four of the six crashes on this rural spot in Hart County were either rear end or same direction sideswipe.
- I 65; MP 136.7-136.8 This spot is on the bridge over the Ohio River in Louisville. Slightly over one-third was a rear end collision with about one-fourth a same direction sideswipe.
- I 71; MP 0.0-0.1 This spot is at the interchange with I 64 in Louisville. The most common collision was a same direction sideswipe involving merging and lane changing.
- I 75; MP 48.9-49.0 There was no pattern to the crashes at this 0.1-mile spot in rural Laurel County.
- I 75; MP 138.0-138.3 Twelve of the 14 crashes at this rural spot in Scott County involved a same direction sideswipe with 57 percent during darkness. A 0.1-mile spot was also identified within this 0.3-mile spot. The crashes were related to construction activity.
- I 65; MP 136.4-136.5 This location is at the interchange with I 65 in Louisville. Most crashes were related to a ramp, merges, and lane changing.

I 65; MP 64.1-64.29 This spot is near the US 31W interchange in Hart County. There was no pattern to the cause of the crashes although three of the six were a same direction sideswipe.

I 75; MP 175.3-175.6 This 0.3-mile spot is around the KY 338 interchange in Boone County with a 0.1-mile spot with a high rate also contained within the range. Approximately one-half of the crashes were same direction sideswipe with several on an interchange ramp or rear end.

There were 11 additional locations which had a CRF between 0.9 and 1.0. The next highest CRF was 0.99 on I 65 between milepoints 132.576 and 132.676 (around Crittenden Road). The majority of the crashes were rear end or same direction sideswipe.

The 1-mile section with the highest CRF was on I 75 between milepoints 172.4 and 173.4 in Boone County. The CRF at this location was 0.87. The interchange with I 71 is located within this section. The most common collision involved a same direction sideswipe.

A review was conducted for fatal crashes involving trucks on interstates for the years of 1994 through 2001. A total of 144 police reports were obtained with a detailed analysis conducted for these crashes. The annual number of fatal crashes ranged from 10 in 1999 to 25 in 2001. There was a fatality to an occupant of the truck in 31 crashes (22 percent). Only 40 percent of the truck drivers and front seat occupants in the trucks who sustained fatal injuries were reported to be using a safety belt.

Following is a frequency listing of the most common crash descriptions resulting from review and investigation of the fatal crash report for the years 1994 through 2001. The list represents a general description of the type of crash from the review of the police report.

<u>Crash Description</u>	<u>Number</u>
Truck hit rear of vehicle in travel lane	30
Vehicle crossed median and hit truck	22
Same direction (vehicle lost control or changing lanes)	21
Vehicle hit rear of truck in travel lane	18
Single vehicle	14
Vehicle hit truck which was stopped on shoulder	11
Truck hit pedestrian in travel lane	9
Truck hit vehicle stopped on shoulder	5
Truck hit pedestrian on shoulder	3
Truck hit vehicle attempting to use median crossover	3
Truck crossed median	2

From a review of the police reports, the primary contributing factor was determined to be an action by the other driver, rather than the truck driver, in 56 percent of the crashes. The most common crash in which the major contributing factor was related to the truck driver occurred when the truck hit the rear of a vehicle in the travel lane. In many of these crashes, the other vehicle was either stopped or slowing for an incident or construction and the truck driver failed to slow appropriately. Eleven of the 30 crashes in which the truck hit the rear of a vehicle in the travel lane occurred between midnight and 6 am. This type of crash is consistent with driver inattention which, in some cases, may be related to driver fatigue related to driving hours or scheduling. Sleep disorders such as sleep apnea or sleep deprivation could be a factor related to driver inattention. Also, a few of the police reports for the rear end crashes specifically noted that the truck driver diverted his attention just prior to the crash for such reasons as changing the radio or adjusting the heater. Other crashes in which the major factor was related to the truck driver involved the truck stopping on the shoulder or the truck driver hitting a vehicle or pedestrian on the shoulder. More than 10 percent of the crashes involved vehicles on shoulders showing the hazard associated with this action.

Following is a summary of the number of fatal truck crashes by interstate, from 1994 through 2001, as well as the number of fatal truck crashes per mile.

<u>Interstate</u>	<u>Number of Fatal Truck Crashes</u>	<u>Fatal Truck Crashes per Mile</u>
I 24	10	0.11
I 64	23	0.12
I 65	39	0.28
I 71	13	0.17
I 75	48	0.25
I 264	3	0.13
I 265	5	0.20
I 275	3	0.12

The data show that I 65 and I 75 had both the highest numbers of fatal crashes as well as the highest number per mile.

There were nine five-mile sections which had five fatal crashes during these eight years. There were three on I 65 and six on I 75. Several crashes involved cars crossing the median or a vehicle stopped on the shoulder. Following are the sections.

I 65	35.7 - 39.2	I 75	74.5 - 78.4
	43.9 - 46.2		78.4 - 82.9
	49.3 - 53.5		94.3 - 98.3
			104.0 - 108.3
			165.1 - 169.4
			182.6 - 186.1

### **3.3 Discussion with Trucking Industry**

General discussions and the review of fatal crash reports with the KAMVS group resulted in several suggestions from the trucking industry related to overall truck safety and specifically to interstate travel. A general area of concern related to a problem with drivers not receiving adequate driver training. It was felt that there was a need for the state to require truck driving schools to provide a minimum amount of classroom instruction and driving training prior to completing the school. Also, the state should be required to administer all written and driving tests for truck drivers in order for the driver to receive a commercial drivers license.

Driver fatigue and sleeping disorders were discussed. Possible actions which could be taken by the trucking industry would be assigning driving schedules so that sleep patterns would not be disrupted and testing for such sleeping disorders as sleep apnea.

## **4.0 RECOMMENDED COUNTERMEASURES**

The following countermeasures were developed to address truck crashes on interstate highways as a result of the review of the current state-of-the-art, an analysis of crash data, and discussion with the trucking industry. The countermeasures were grouped into the general areas of: a) the roadway environment, b) the truck, and c) the driver.

### **4.1 Roadway Environment**

- a. Provide additional parking facilities (encourage use of weigh stations and rest havens for parking).
- b. Publicize the locations of current parking facilities (and the hazards of improper parking on shoulders). A list of available parking spaces is available (7).
- c. Restrict parking and enforce parking limitations on shoulders.
- d. Include audible rumble strips on shoulders on all reconstruction and resurfacing projects.
- e. Consider increased use of median barriers.
- f. Use Intelligent Transportation Systems (ITS) technology to provide real time congestion/incident information (using changeable message signs (CMS), Highway Advisory Radio (HAR) and citizen band (CB) radio).
- g. Use roadway weather information systems (RWIS) to provide real time weather information through CMS, HAR and CB radio.

- h. Use Commercial Vehicle Electronic Screening to reduce congestion at weigh stations.
- i. Consider lane use restrictions on roads with three or more lanes in one direction (especially in rural areas).
- j. Consider restricting trucks from the left lane at locations with steep upgrades and install warning signs for slow moving trucks.
- k. Construct truck climbing lanes for steep upgrades.
- l. Use speed monitoring equipment and CMS in advance of ramps with low design speeds to warn truck drivers if their speed is excessive.
- m. Emphasize truck operation needs in the design of work zones.

## **4.2 Truck**

- a. Provide proper rear-end protection (consider an energy absorbing treatment).
- b. Provide adequate lighting and reflective material on the rear of the truck.
- c. Consider use of ITS technology to warn a driver if the truck is closing too fast on an object.
- d. Use Infrared Inspection Systems (IRIS) or other technologies to detect deficient brakes on trucks.
- e. Provide adequate mirrors to minimize blind spots.
- f. Consider use of ITS technology to warn a driver if there is an object to the side of his truck in a blind spot.
- g. Consider use of ITS technology related to driver drowsiness detection systems.
- h. Consider use of equipment which will provide the driver a warning if the truck is approaching its rollover threshold.

### 4.3 Driver

- a. Require truck driving schools to provide a minimum amount of classroom instruction and driving (on-road) training prior to completing the school.
- b. Require the state to administer all written and driving tests for truck drivers in order for the driver to receive a commercial drivers license (CDL).
- c. Emphasize the requirement for truck drivers to use a safety belt.
- d. Publicize the location of blind spots around trucks to both truck drivers and the general driving population.
- e. Provide education concerning the hazards of improperly parking on highway shoulders.
- f. Provide information giving the location of available parking facilities (7).
- g. Emphasize the importance of obtaining the required hours of rest and not to exceed the maximum number of driving hours.
- h. Trucking companies could test drivers for sleep disorders such as sleep apnea or the driver could be tested prior to receiving a CDL.
- i. Trucking companies should assign driving schedules to minimize the disruption to driver's sleep patterns.
- j. Provide education concerning the hazards related to road construction.
- k. Provide education concerning the handling characteristics of trucks (i.e. braking and steering capabilities), the need to drive defensively since the crash avoidance of a truck is limited, and use of emergency flashers when driving slowly up a steep grade.

## 5.0 REFERENCES

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TABLE 1. COMPARISON OF ALL INTERSTATE CRASHES WITH TRUCK CRASHES  
(2000 Data)

VARIABLE	CATEGORY	PERCENT OF TOTAL		
		ALL	TRUCK	COMMERCIAL VEHICLE
Severity	Fatal	0.66	0.70	0.81
	Injury	23.4	22.2	22.9
Day of Week	Weekday	74.3	82.4	82.3
	Weekend	25.7	17.6	17.7
Number of Vehicles	One	33.4	16.5	15.6
	Two	57.5	72.5	73.5
	More than Two	9.1	11.0	10.8
Road Surface	Dry	73.3	79.5	79.3
	Wet	19.2	14.7	15.1
	Snow/Ice	7.5	5.9	5.5
Roadway Character	Curve/Grade	12.1	10.2	10.1
	Curve/Hillcrest	1.9	1.6	1.5
	Curve/Level	8.5	6.9	6.9
	Straight/Grade	23.0	24.1	24.5
	Straight/Hillcrest	3.8	3.4	3.5
	Straight/Level	50.7	53.9	53.4
Light Condition	Daylight	67.7	66.6	65.3
	Dawn/Dusk	5.0	4.7	5.0
	Darkness/No Lighting	12.8	15.3	15.9
	Darkness/Lighted	14.5	13.4	13.8
Time of Day	Midnight-5:59 am	11.2	12.0	12.7
	6 am - 11:59 am	28.7	30.2	30.1
	Noon - 5:59 pm	40.1	37.7	36.9
	6 pm - 11:59 pm	20.0	20.0	20.3

TABLE 1. COMPARISON OF ALL INTERSTATE CRASHES WITH TRUCK CRASHES  
(2000 Data) (continued)

VARIABLE	CATEGORY	PERCENT OF TOTAL		
		ALL	TRUCK	COMMERCIAL VEHICLE
Month	December - February	26.5	24.9	25.2
	March - May	23.8	24.8	24.7
	June - August	25.2	24.9	24.3
	September - November	24.6	25.5	25.8
Directional Analysis	Intersection	4.5	3.7	3.4
	Non-Intersection			
	Rear End in Traffic Lane	21.9	19.4	19.8
	Shoulder/Parked Vehicle	3.1	3.8	3.7
	Head-on/Opposite Dir.	0.9	1.2	1.2
	Same Direction Sideswipe	14.6	33.9	35.0
	Entrance	1.9	3.8	3.9
	Median Crossover	0.1	0.3	0.3
	Wrong Direction	<0.1	<0.1	<0.1
	Pedestrian	0.2	0.4	0.5
	Fixed Object	14.1	6.8	6.8
	Ran off Roadway	9.4	8.0	7.6
	Overtuned in Road	0.5	0.4	0.2
	Animal	4.5	2.5	2.6
	Ramp	19.5	10.6	10.0
Other	4.8	5.1	4.9	
Type Crash/ 1 <sup>st</sup> Event	Animal	1.2	0.8	0.8
	Deer	3.5	1.8	1.9
	Other Motor Vehicle	63.8	75.8	76.8
	Pedestrian	0.2	0.4	0.5
	Object/not fixed	3.3	3.0	2.7
	Fixed Object	22.8	9.9	9.7
	Non-collision	4.7	6.8	6.3

TABLE 1. COMPARISON OF ALL INTERSTATE CRASHES WITH TRUCK CRASHES  
(2000 Data) (continued)

VARIABLE	CATEGORY	PERCENT OF TOTAL		
		ALL	TRUCK	COMMERCIAL VEHICLE
Counties with Highest Number	Jefferson	38.6	26.7	25.9
	Kenton	11.4	11.7	11.9
	Boone	6.5	9.1	9.3
	Fayette	3.3	3.2	3.0
	Warren	2.8	3.4	3.7
	Shelby	2.6	2.5	2.4
	Madison	2.6	2.8	2.9
	Campbell	2.5	0.8	0.6
	Hardin	2.5	4.2	4.5
	Scott	2.4	3.6	3.9
	Grant	2.4	3.1	3.1
	Bullitt	2.0	3.1	3.1
	McCracken	1.8	1.3	1.1
	Rockcastle	1.6	2.8	2.9
	Franklin	1.6	1.2	1.1
	Laurel	1.6	2.6	2.7
Oldham	1.4	1.9	2.0	
Whitley	1.1	1.8	1.8	
Contributing Factors (Percent of all Crashes)	Environmental			
	Animal Action	4.1	2.6	2.8
	Road Construction	5.4	10.3	11.0
	Debris	2.6	3.1	3.0
	Glare	0.3	0.1	0.1
	Holes/Bumps	0.2	0.4	0.2
	Improperly Parked	0.3	0.5	0.6
	Maintenance Work Zone	0.5	1.1	1.1
	Defective Shoulder	0.1	0.1	0.1
	Slippery Surface	15.3	13.0	13.0
	View Limited	1.1	2.6	2.7
Water Pooling	2.7	1.5	1.7	

TABLE 1. COMPARISON OF ALL INTERSTATE CRASHES WITH TRUCK CRASHES  
(2000 Data) (continued)

VARIABLE	CATEGORY	PERCENT OF TOTAL		
		ALL	TRUCK	COMMERCIAL VEHICLE
Contributing Factors (Percent of all Crashes)	Human			
	Alcohol	3.5	2.3	2.0
	Cell Phone	0.3	0.1	0.2
	Disregard Traffic Control	0.6	0.9	1.0
	Distraction	2.3	1.7	1.7
	Drug	0.4	0.2	0.2
	Emotional	0.3	0.5	0.5
	Exceeded Speed Limit	2.0	1.7	1.6
	Failed to Yield	5.9	13.7	14.0
	Fatigue	0.6	0.6	0.7
	Fell Asleep	3.1	2.7	2.8
	Following too Close	13.7	9.0	9.0
	Improper Backing	0.2	0.3	0.4
	Improper Passing	0.6	1.0	1.0
	Inattention	30.5	31.1	31.5
	Lost Consciousness	0.5	0.6	0.6
	Medication	0.6	0.2	0.2
	Misjudge Clearance	2.6	5.0	5.2
	Not Under Proper Control	9.9	9.1	8.5
	Overcorrecting	3.4	2.0	2.2
	Physical Disability	0.2	<0.1	<0.1
	Sick	0.5	0.4	0.5
	Too Fast for Conditions	7.9	5.4	5.5
	Turning Improperly	0.5	0.8	0.9
	Weaving in Traffic	0.6	0.7	0.7
	Vehicular			
	Brakes	0.5	1.1	1.2
	Lighting	0.1	0.1	0.1
	Load Securement	1.0	2.9	2.9
	Oversize Load	0.3	0.7	0.6
	Overweight	0.1	0.1	0.1
	Steering	0.3	0.2	0.3
	Tire	2.8	2.6	2.5
	Tow Hitch/Separation	0.3	0.7	0.4

TABLE 2. COMPARISON OF ALL FATAL INTERSTATE CRASHES WITH FATAL TRUCK CRASHES (1998-2000 Data)

VARIABLE	CATEGORY	PERCENT OF TOTAL		
		INTERSTATE ALL	TRUCK	ALL TRUCK
Day of Week	Weekday	64.4	72.4	87.6
	Weekend	35.6	27.6	12.4
Number of Vehicles	One	50.0	13.8	18.8
	Two	34.7	56.9	64.3
	More than Two	15.3	29.3	16.9
Road Surface	Dry	73.3	79.5	79.3
	Wet	19.2	14.7	15.1
	Snow/Ice	7.5	5.9	5.5
Roadway Character	Curve/Grade	6.4	6.9	14.7
	Curve/Hillcrest	1.0	0.0	2.3
	Curve/Level	4.5	0.0	11.3
	Straight/Grade	29.2	36.2	27.2
	Straight/Hillcrest	0.5	0.0	2.3
	Straight/Level	58.4	56.9	42.2
Light Condition	Daylight	53.5	59.6	72.1
	Dawn/Dusk	4.0	5.3	4.5
	Darkness/No Lighting	29.0	21.1	17.4
	Darkness/Lighted	13.5	14.0	6.0
Time of Day	Midnight-5:59 am	31.2	25.9	13.9
	6 am - 11:59 am	21.8	29.3	35.7
	Noon - 5:59 pm	34.1	31.0	40.2
	6 pm - 11:59 pm	12.9	13.8	10.2

TABLE 2. COMPARISON OF ALL FATAL INTERSTATE CRASHES WITH FATAL TRUCK CRASHES (1998-2000 Data) (continued)

VARIABLE	CATEGORY	PERCENT OF TOTAL		
		INTERSTATE ALL	TRUCK	ALL TRUCK
Month	December - February	17.3	13.8	18.1
	March - May	24.8	25.9	24.4
	June - August	29.2	25.9	25.9
	September - November	28.7	34.4	31.6
Directional Analysis	Intersection	2.5	3.4	23.7
	Non-Intersection			
	Rear End in Traffic Lane	13.9	24.1	11.3
	Shoulder/Parked Vehicle	7.4	15.5	5.6
	Head-on/Opposite Dir.	9.4	6.9	21.0
	Same Direction Sideswipe	5.0	12.1	2.6
	Entrance	3.5	6.9	6.4
	Median Crossover	0.0	0.0	0.4
	Wrong Direction	0.0	0.0	0.4
	Pedestrian	7.4	8.6	7.9
	Fixed Object	23.8	6.9	6.0
	Ran off Roadway	9.4	0.0	4.5
	Overtuned in Road	9.9	1.7	3.0
	Animal	0.5	0.0	0.0
	Ramp	3.0	0.0	0.4
Other	4.5	13.8	6.0	
Type Crash/ 1 <sup>st</sup> Event	Animal	0.0	0.0	0.0
	Deer	0.5	0.0	0.0
	Other Motor Vehicle	43.6	77.2	76.2
	Pedestrian	6.9	8.8	7.9
	Object/not fixed	2.0	1.7	0.8
	Fixed Object	27.7	8.8	8.7
	Non-collision	18.8	3.5	6.0

TABLE 2. COMPARISON OF ALL FATAL INTERSTATE CRASHES WITH FATAL TRUCK CRASHES (1998-2000 Data) (continued)

VARIABLE	CATEGORY	PERCENT OF TOTAL		
		INTERSTATE ALL	TRUCK	ALL TRUCK
Counties with Highest Number	Jefferson	21.3	19.0	9.8
	Warren	7.4	12.1	4.1
	Madison	6.4	6.9	4.1
	Kenton	5.0	3.4	1.5
	Fayette	4.5	6.9	3.0
	Hardin	4.5	3.4	1.5
Contributing Factors (Percent of all Crashes)	Environmental			
	Animal Action	1.0	0.0	0.0
	Road Construction	5.0	15.5	3.4
	Debris	2.0	1.7	0.8
	Glare	1.0	1.7	0.8
	Holes/Bumps	0.0	0.0	0.0
	Improperly Parked	1.0	3.5	1.5
	Maintenance Work Zone	0.0	0.0	0.0
	Defective Shoulder	0.0	0.0	0.0
	Slippery Surface	4.5	5.2	9.8
	View Limited	2.0	3.5	3.8
	Water Pooling	0.5	0.0	1.5
	Vehicular			
	Brakes	1.0	3.5	4.9
	Lighting	0.5	1.7	1.1
	Load Securement	0.0	0.0	4.5
Oversize Load	1.0	1.7	1.5	
Overweight	0.1	0.0	1.1	
Tire	3.5	3.4	1.5	

TABLE 2. COMPARISON OF ALL FATAL INTERSTATE CRASHES WITH FATAL TRUCK CRASHES (1998-2000 Data) (continued)

VARIABLE	CATEGORY	PERCENT OF TOTAL		
		INTERSTATE ALL	TRUCK	ALL TRUCK
Contributing Factors	Human			
(Percent of all Crashes)	Alcohol	10.9	3.4	4.1
	Cell Phone	0.0	0.0	0.0
	Disregard Traffic Control	0.5	0.0	8.3
	Distraction	4.0	3.5	2.3
	Drug	0.5	1.7	1.5
	Exceeded Speed Limit	15.6	6.7	6.7
	Failed to Yield	4.0	8.6	22.6
	Fatigue	1.6	0.0	1.1
	Fell Asleep	12.9	8.6	3.8
	Following too Close	1.0	0.0	0.4
	Inattention	22.8	37.9	26.7
	Lost Consciousness	0.0	0.0	0.4
	Misjudge Clearance	1.6	0.0	0.0
	Not Under Proper Control	12.5	6.7	18.0
	Overcorrecting	7.8	0.0	4.5
	Physical Disability	1.5	0.0	0.8
	Sick	1.0	1.7	0.8
	Too Fast for Conditions	11.9	8.6	11.3
	Turning Improperly	1.5	3.4	3.0
	Weaving in Traffic	1.6	6.7	1.1

**APPENDIX DESCRIPTION OF FATAL CRASHES**

## FATAL CRASHES INVOLVING TRUCKS ON INTERSTATES IN 2001

<u>LOCATION</u>	<u>DESCRIPTION</u>
I 24; MP 0.7	Truck ran into rear of sport utility vehicle (SUV) slowing to estimated speed of 10-15 mph due to mechanical problem; no full width shoulder available on long bridge; day; dry; just past apex of Ohio River bridge; truck driver stated he had looked away from road just prior observing slow moving vehicle.
I 24; MP 4.0	Car crossed median hitting two SUVs (one pulling trailer).
I 24; MP 61.5	Right front of loaded truck hit left rear of van when driver misjudged the clearance during passing maneuver; 2:44 am.
I 64; MP 1.0*	Single vehicle; loaded truck overturned on ramp; dark with roadway lighting; speed limit 55 mph with advisory speed; speed estimate 60 mph; seat belt not in use.
I 64; MP 53.7	Multiple vehicle crash after car lost control on wet pavement when changed lanes (vehicle merging at on-ramp).
I 64; MP 83.7*	Single vehicle; loaded truck ran off road, overcorrected and overturned; 4:50 pm; dry; unrestrained driver ejected; speed estimate 70-75 mph.
I 64; MP 126.3	Car hit guardrail and then crossed median colliding with truck.
I 65; MP 4.2	Car lost control in rain and crossed median colliding with loaded truck.
I 65; MP 32.7	Truck hit pedestrian working on vehicle on shoulder; distraction listed; 3:27 am; construction work zone with workers not present.
I 65; MP 43.9*	Loaded truck crossed median and collided with car; daylight; 6:44 am; unrestrained driver of truck fatally injured.
I 65; MP 69.4	Car lost control in rain, slid into guardrail, and back into path of following loaded truck.

C Truck driver sustained fatal injury.

Note: Truck refers to a combination truck unless noted otherwise.

**FATAL CRASHES INVOLVING TRUCKS ON INTERSTATES IN 2001 (continued)**

<u>LOCATION</u>	<u>DESCRIPTION</u>
I 65; MP 78.5	Pickup sideswiped truck as passing; alcohol involvement noted.
I 65; MP 95.9*	Loaded truck ran into rear of another loaded truck which was driving slow due to upgrade (40-50 mph with flashers on); 4:35 pm; seat belt not in use.
I 65; MP 122.5	SUV crossed median colliding with single unit truck.
I 71; MP 9.7	Driver of empty truck fell asleep and crossed median hitting car and SUV; 9:48 am.
I 71; MP 10.0	Car sideswiped another vehicle when passing and crossed median hitting loaded truck.
I 75; MP 6.4	Van ran into rear of loaded truck stopped in construction zone; truck had flashers on; dusk.
I 75; MP 78.4	Loaded single unit truck ran into rear of car slowing for construction zone; speed limit 55mph.
I 75; MP 108.3	Single vehicle; lost control, driver overcorrected and overturned; Ford Excursion pulling trailer.
I 75; MP 150.7	Loaded truck ran over motorcycle lying in road from previous incident.; darkness with no lighting; hillcrest; black clothing for cyclist.
I 75; MP 166.1	Car lost control (at end of third SB lane) as passing and crossed median and collided with truck; alcohol noted.
I 75; MP 183.8	Head on collision between car and pickup on ramp when driver fleeing another accident scene; only truck involvement was construction barrel thrown into its windshield.
I 75; MP 186.1	Car (speed 70-75 mph) ran into rear of truck slowing to 20-25 mph for congestion; speed limit 55 mph.
I 265; MP 15.9	Truck ran into rear of vehicles stopped for previous crash.
I 275; MP 1.0	Car ran into rear of double trailer stopped for previous crash.

## FATAL CRASHES INVOLVING TRUCKS ON INTERSTATES IN 2000

<u>LOCATION</u>	<u>DESCRIPTION</u>
I 24; MP 77.2*	Single vehicle; driver lost control (related to drinking coffee) and ran onto shoulder where struck abandoned vehicle and then traveled about 300 feet before colliding with trees; load shifted forward and crushed cab; driver restrained; also fatality to occupant of sleeper compartment.
I 24; MP 77.2	SUV attempted to turn left into median and turned in front of loaded truck.
I 24; MP 87.5	Loaded truck ran into rear of pickup after truck driver diverted his attention while changing radio station.
I 64; MP 27.2*	Single vehicle; loaded truck ran off road and traveled about 450 feet before colliding with trees; 4:16 pm; seat belt in use.
I 65; MP 0.3*	Multiple rear end when loaded truck ran into rear of another loaded truck; vehicles stopped at construction zone; seat belt in use.
I 65; MP 35.7*	Loaded truck hit left rear corner of another loaded truck which was stopped in the emergency lane; 7 am; defective brakes listed for truck stopped on shoulder relating to reason for stopping; seat belt in use.
I 65; MP 37.8*	Loaded truck failed to slow (from estimated 70 to 75 mph) for slow traffic at road construction resulting in multiple vehicle rear end collisions; driver restrained; also fatality to occupant of sleeper compartment.
I 65; MP 39.2	Car at estimated speed of 90 to 95 mph lost control while changing lanes and rotated into side of loaded truck.
I 65; MP 44.5	Loaded truck hit pedestrian; 4:58 am; alcohol and darting into road listed for pedestrian.
I 65; MP 53.4	Car crossed median and collided with loaded truck.
I 65; MP 112.7	Loaded truck sideswiped pickup and traveled onto shoulder where three trucks were parked; 3:15 am; vicinity of rest area.

## FATAL CRASHES INVOLVING TRUCKS ON INTERSTATES IN 2000

<u>LOCATION</u>	<u>DESCRIPTION</u>
I 65; MP 133.6*	Rear end collision involving three vehicles; driver of empty truck hit car pushing in into another truck; traffic slowing; brakes on trailer found to be defective; 12:51 pm; unrestrained driver sustained fatal injuries.
I 71; MP 10.3	Driver of loaded single unit truck ran into rear of SUV pushing it into a truck; traffic stopped due to congestion; 8:10 am.
I 75; MP 82.9	Car attempted to turn left from shoulder into median and hit in side by loaded truck; in construction zone.
I 75; MP 86.7	SUV towing boat too large for vehicle lost control and sideswiped loaded truck and then SUV overturned in median.
I 75; MP 88.8	Car lost control on wet pavement when passing a truck and rotated into guardrail and then into side of truck.
I 265; MP14.8	Car (alcohol involvement for driver) hit rear of another car pushing it into unoccupied truck on shoulder (vehicle was Ford 350 pickup should not have been coded as truck).

## FATAL CRASHES INVOLVING TRUCKS ON INTERSTATES IN 1999

<u>LOCATION</u>	<u>DESCRIPTION</u>
I 24; MP 25.0*	Loaded truck ran into rear of another loaded truck; 4:37 am; lap belt in use.
I 64; MP 16.7	Car ran into rear of stopped truck; dry; dusk.
I 64; MP 35.3	Loaded truck ran into rear of car slowing for traffic which was stopped; truck driver stated looked away to check on items which had fallen in cab.
I 64; MP 55.0*	Same direction sideswipe collision as car starting in traffic; view obstructed; fatal injury to unrestrained truck driver who was ejected.
I 64; MP 111.8*	Tractor ran into rear of car and pickup slowing in traffic; restrained truck driver fatally injured.
I 64; MP 150.9*	Single vehicle; fixed object (guardrail end); 9 am; not restrained.
I 71; MP 2	Truck ran into rear of car stopped in traffic resulting from previous crash; 0:25 am; pedestrian fatality.
I 71; MP 7.6	Car crossed median hitting truck.
I 75; MP 1.0	Same direction collision on snow.
I 75; MP 98.3	Car driver fell asleep and hit single unit truck parked on shoulder; disagreement concerning whether lights on truck illuminated; roadway lighted; 3:45 am.

## FATAL CRASHES INVOLVING TRUCKS ON INTERSTATES IN 1998

<u>LOCATION</u>	<u>DESCRIPTION</u>
I 71; MP 30	Pickup ran into rear of truck in travel lanes; alcohol; dark.
I 75; MP 10	Same direction; speed factor for car; dark.
I 75; MP 26.1	Truck ran into rear of car; both moving in travel lane; 11:21 am.
I 75; MP 28.1	Multi-vehicle; truck ran into line of slowing and stopped vehicles; 1:10 pm; speed; inattention.
I 75; MP 47.0	Van ran into rear of stopped truck; drug involvement; 7:32 am.
I 75; MP 51.7	Truck ran into rear of car stopped on shoulder; 3:57 am.
I 75; MP 82.9	Car ran into rear of truck stopped on shoulder; 6:50 am; near rest area.
I 75; MP 94.8	Truck ran into rear of slowing and stopping vehicles; 11:10 am.
I 75; MP104	Same direction; overtaking; 4:25 pm; van overturned; note that truck listed as vehicle 1 on police report.
I 75; MP114.2	Pedestrian stepped into road from next to stopped vehicle; alcohol; 3:12 am.
I 75; MP 158.5	Pedestrian crossed road in path of loaded truck; 11:36 am.
I 75; MP 177.6	Car ran into empty truck stopped on shoulder with part of vehicle in travel lane; driver said stopped to make repairs and sleeping when collision occurred; adjacent to rest area; 4:53 am.
I 75; MP 183.7	Car had tire failure and ran into side of loaded truck stopped on shoulder; truck driver had stopped when road previously closed for accident and was asleep when collision occurred; 3:05 am.
I 264; MP 17.5	Same direction; pickup driver lost control when changing lanes and hit side of single unit truck and overturned.
I 275; MP 0	Truck hit pedestrians at vehicle on shoulder; driver inattention; 3:20 pm.

## FATAL CRASHES INVOLVING TRUCKS ON INTERSTATES IN 1997

<u>LOCATION</u>	<u>DESCRIPTION</u>
I 64; MP 12*	Rear end collision involving three loaded trucks when one slowed to pull onto the emergency lane; fatality to passenger using seat belt.
I 64; MP 15.2	Head on with loaded truck when car went wrong way on interstate (alcohol noted).
I 65; MP 51.0	Head on when car driver lost control, crossed median, and hit empty truck.
I 65; MP 71.0*	Single vehicle; loaded truck ran off road and overturned; driver not restrained; report opinion that driver fell asleep; 1 am.
I 65; MP 118*	Rear end on shoulder involving two loaded trucks; 0:15 am; lap belt in use.
I 71; MP 9.8	Car crossed median hitting loaded truck; alcohol and drugs.
I 75; MP 10.5*	Rear end involving two loaded trucks; 2:15 am; driver hit from rear estimated speed as 50 to 55 mph; lap belt in use.
I 75; MP 41	Van crossed path into path of loaded truck.
I 75; MP 52.3	Pickup crossed median and hit truck.
I 75; MP 74.5	Pickup ran into rear of loaded truck; estimated speed of truck 55 to 60 mph; alcohol noted.
I 75; MP 74.8*	Single unit truck ran into rear of loaded truck which was attempting to pull back into traffic after stopped to pick up pedestrian; 1:05 am; lap belt in use.
I 75; MP 94.3*	Single vehicle; empty truck ran off road and overturned when avoiding vehicles slowing for construction; unrestrained driver ejected.

**FATAL CRASHES INVOLVING TRUCKS ON INTERSTATES IN 1997 (continued)**

<b><u>LOCATION</u></b>	<b><u>DESCRIPTION</u></b>
I 75; MP 98.3	Single unit truck hit pedestrian who stepped into road from disabled vehicle; darkness.
I 75; MP 165.1	Car being towed by rental truck became unattached and crossed median hitting car.
I 75; MP 169.4	Car driver lost control and rotated into path of loaded truck; snow.
I 75; MP 189.4	Truck driver lost control with trailer hitting car beside truck.
I 264; MP 8	Car hit pedestrian assisting previous crash and then hit stopped truck.

## FATAL CRASHES INVOLVING TRUCKS ON INTERSTATES IN 1996

<u>LOCATION</u>	<u>DESCRIPTION</u>
I 24; MP 36.4	Car ran into rear of loaded truck slowing to exit at weigh station.
I 64; MP 40.2*	Single vehicle; loaded double trailer ran into guardrail and bridge structure; defective brakes listed as factor; driver using seat belt.
I 64; MP 49.7*	Single vehicle; overturned in road; 5:45 am; falling asleep noted; safety belt not in use.
I 64; MP 98.3	Car ran into rear of empty truck stopped on shoulder (not for emergency purpose); 4:25 am; at end of rest area entrance ramp; car driver fell asleep.
I 65; MP 16.7	Car crossed median and hit empty truck; alcohol.
I 65 MP 37.8*	Empty truck ran into rear of loaded truck; 0:45 am; review of driver log indicated lack of sleep with opinion driver fell asleep; safety belt not in use.
I 65; MP 46.2	Loaded truck ran into rear of cars on shoulder; police making traffic stop; truck driver fell asleep; 4:55 am.
I 65; MP 65.4*	Car crossed median and hit loaded truck; fatalities in both vehicles with truck driver not using safety belt.
I 65; MP 81.4	Car ran into rear of loaded truck which had just merged from rest area; 7:45 am; car driver fell asleep.
I 65; MP 83.2	Pickup driver lost control on ice and crossed median and hit truck.
I 65; MP 104.5	Loaded truck hit pedestrian crossing road; alcohol.
I 65; MP 110.4	Loaded truck ran into rear of car stopped because of accident; 11:44 pm.
I 71; MP 4.7*	Single vehicle; loaded truck (gasoline) overturned in road; curve; safety belt use unknown.
I 71; MP 25.3	Car ran into rear of truck (pickup with trailer) working at construction area which was slowing to stop on emergency lane; lighting defective on rear of trailer.

## FATAL CRASHES INVOLVING TRUCKS ON INTERSTATES IN 1996 (continued)

<u>LOCATION</u>	<u>DESCRIPTION</u>
I 71; MP 39.5*	Single unit; loaded truck ran off road; 8:11 am; dry; just left weigh station; four miles after placed out of service for log book violation; safety belt not in use.
I 75; MP 43.6	Loaded truck hit pedestrian crossing road.
I 75; MP 66.3	Loaded truck ran into rear of car; truck driver stated he adjusted heater and then saw car when he looked back; 1:45 am.
I 75; MP 81.3*	Loaded truck lost control on ice and hit two other trucks; unrestrained driver partially ejected.
I 75; MP 106.2	Van lost control on ice and slid in front of loaded truck.
I 75; MP 182.6	Loaded truck ran into rear of slow moving car when driver diverted attention and looked in mirror.
I 265; MP 26.1	Car crossed median and hit empty truck.
I 275; MP 72.9	Car ran into rear of single unit truck stopped on shoulder; car driver diverted attention to accident on opposite side of road.

## FATAL CRASHES INVOLVING TRUCKS ON INTERSTATES IN 1995

<u>LOCATION</u>	<u>DESCRIPTION</u>
I 24; MP 33.5	Car crossed median and hit loaded truck; rain.
I 24; MP 90.1	Loaded truck sideswiped car when changed from left to right lane; truck driver stated did not see car.
I 64; MP 5.0	Truck hit pedestrian crossing roadway.
I 64; MP 49.5	Car hit rear of empty truck stopped on shoulder as driver assisted motorist; 3:15 am.
I 64; MP 60.3	Car crossed median and opposing lanes and hit loaded truck which was parked in rest area.
I 64; MP 82.4	Car driver lost control on icy road and hit empty truck and other vehicles.
I 64; MP 90.3	Loaded truck hit rear of escort vehicle and wide load which had just pulled back onto road from shoulder (pulled onto shoulder for mechanical problem).
I 64; MP 178.3	Van ran into rear of loaded truck which was traveling at slow speed due to icy conditions; 11 pm.
I 64; MP 93.8	Truck hit pedestrian crossing road from parked vehicle; 3 am.
I 65; MP 0.6	Wheel came off trailer of loaded truck traveling along interstate and hit pedestrian in rest area.
I 65; MP 49.3*	Single vehicle; loaded truck ran off road and overturned; unrestrained driver ejected; 2 am; driver fell asleep.
I 65; MP 45.8	Empty truck hit car stopped on shoulder for driver to sleep; 5:30 am.
I 65; MP 91.3	Loaded truck hit car while changing lanes (fast lane to middle lane); truck driver did not see car; 10:46 pm

## FATAL CRASHES INVOLVING TRUCKS ON INTERSTATES IN 1995

<u>LOCATION</u>	<u>DESCRIPTION</u>
I 71; MP 37.2	Car crossed median and hit unloaded truck.
I 75; MP 4.5	Loaded truck ran into rear of car; truck driver noted dim taillights on car; 6 am.
I 75; MP 21.4	Car slid on ice into rear of loaded truck stopped in road due to traffic backup.
I 75; MP 29.2	Loaded truck slid on wet pavement into rear of vehicle stopped for previous accident and hit pedestrian who had exited this vehicle.
I 75; MP 112.2	Loaded truck crossed edgeline and hit pedestrian working on car stopped on shoulder; 1:25 am.
I 75; MP 174.9	Car ran into rear of loaded truck stopped on shoulder of ramp cleaning window; rain; emergency flashers on.
I 264; MP 9	Van ran into rear of loaded truck; 2:34 am; fell asleep; truck had been placed out of service previous day for defective brakes and tires.
I 265; MP 22.4	Van hit rear of single unit work truck in construction zone.

## FATAL CRASHES INVOLVING TRUCKS ON INTERSTATES IN 1994

<u>LOCATION</u>	<u>DESCRIPTION</u>
I 64; MP 4.2	Multi-vehicle crash involving truck; car parked partially on shoulder and partially in road; truck driver's license had been suspended.
I 65; MP 19.2	Pickup hit rear of single unit truck (DOH truck) stopped on shoulder.
I 65; MP 25.8	Pickup (pulling trailer) ran into rear of loaded truck stopped in road due to previous crash.
I 65; MP 53	Car crossed median and hit single unit truck.
I 65; MP 57.6	Van ran into rear of loaded truck stopping for traffic on exit ramp.
I 65; MP 79	Car lost control as it and loaded truck were changing lanes to pass.
I 65; MP 81.8	Car hit empty truck jackknifed in road from previous crash; 2 am; truck had lights on and driver was attempting to place flares.
I 65; MP 106.3	Loaded truck hit pickup stopped in slow lane; 3:55 am with no lights on pickup; alcohol for pickup driver.
I 65; MP 117.0	Car crossed median and hit car and loaded truck; alcohol.
I 65; MP 125	Pickup ran into rear of loaded truck which had just entered road from on-ramp; 2:40 am.
I 71; MP 14.1*	Car lost control on icy bridge and slid into loaded truck; truck driver unrestrained.
I 71; MP 41.2*	Tire came off loaded single unit truck which ran off road and overturned; driver unrestrained.

**FATAL CRASHES INVOLVING TRUCKS ON INTERSTATES IN 1994 (continued)**

<b><u>LOCATION</u></b>	<b><u>DESCRIPTION</u></b>
I 75; MP 63.2*	Truck ran into rear of single unit truck; 6:10 am; driver unrestrained.
I 75; MP 75.7	Car crossed median and hit loaded truck.
I 75; MP 105.6	Car attempted to cross road from shoulder to median crossover when hit by loaded truck.
I 75; MP 167.0	Pickup crossed median and hit loaded truck.
I 265; MP 25.5	Bobtail tractor lost control when attempting to exit and hit pickup; rain.